European Hydrogen and Fuel Cell Technology Platform

EU Initiative Group – Regulations, Codes & Standards

Current Status & Action Plan

for

Implementing Hydrogen Regulations, Codes & Standards in the EU

February 2005 (Rev 2)

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Action Plan Objectives

- Facilitate the creation and adoption of regulations, codes & standards in stationary, residential & transportation applications
- Harmonise the technical requirements of regulations, international codes & standards
- Integrate codes & standards from R&D to commercialisation

Source: NHA

Considerations for Hydrogen RCS

Deployment Strategy Report - Targeted ‘Snapshot 2020’

- Fulfill the goals of industry & the EU to create a commercially viable hydrogen energy & fuel market by 2020, initially focussing on the transportation sector with the underlying hydrogen manufacture, supply & distribution infrastructure.

Strategic Research Agenda Report

- FCs for vehicles major driver for FC development
- Stationary FCs major contribution to CO2 savings via CHP
- Portable FCs: substantial contribution to early market introduction of FC technology

Current situation:
EU Directives& International Regulations

- Legal Requirements and Regulations are ranked above standards
- UN Global Technical Regulation [1998 Agreement]
  UNECE Regulation [1958 Agreement]
  EEC Directives
  National Directives and Regulations

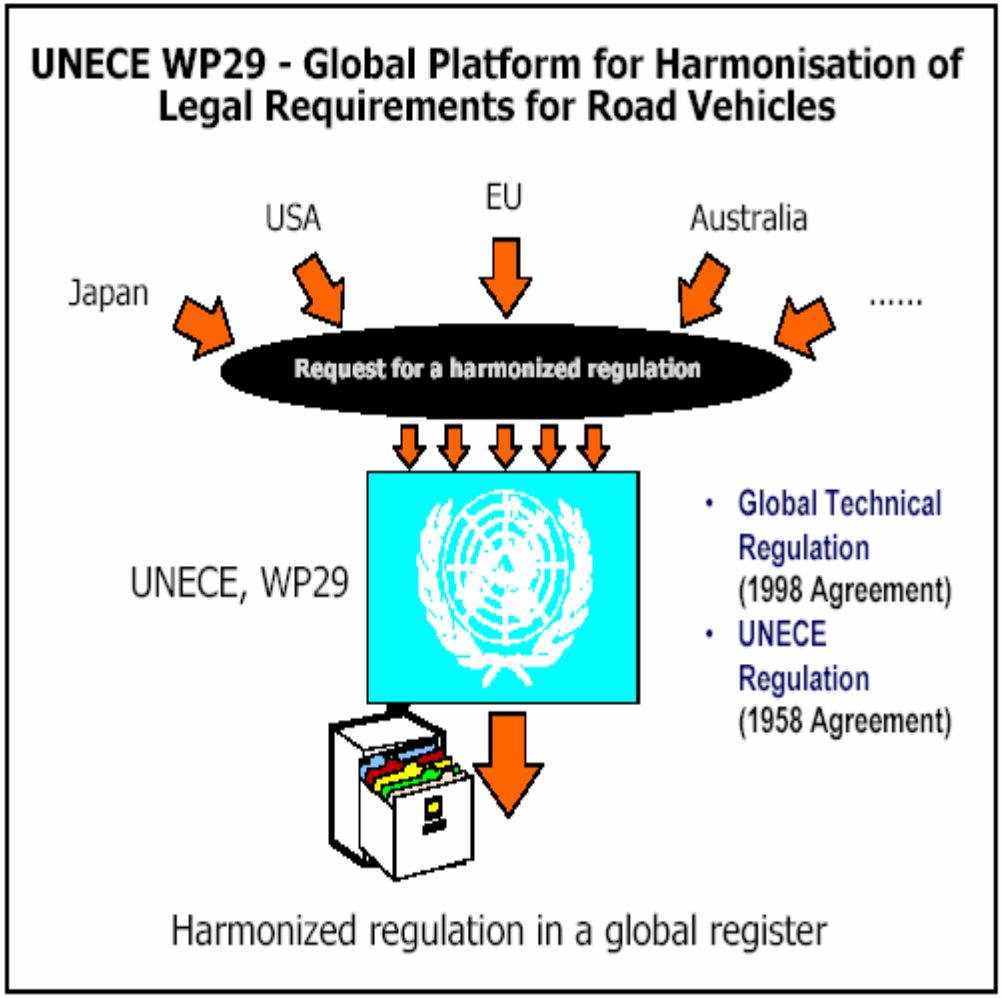
  } Road-Vehicle Applications

- Important directives regarding stationary hydrogen technologies and infrastructure systems are:
  - ATEX directives
  - PED (Pressurised Equipment Directive)
  - EMC (electromagnetic compatibility) directive
  - The Machinery Safety Directive
  - SEVESO II (large amounts of haz. mat.)
  - Transport of dangerous goods by road
  - UN IMO

Remember:
Standards are an industry convention and NOT legally binding !
Legal requirements override standards !

Sources: Norsk Hydro – 2003, LBST - 2004

Approval of H2 Road Vehicles in Europe
Global Platform for Harmonisation of Regulations for Road Vehicles

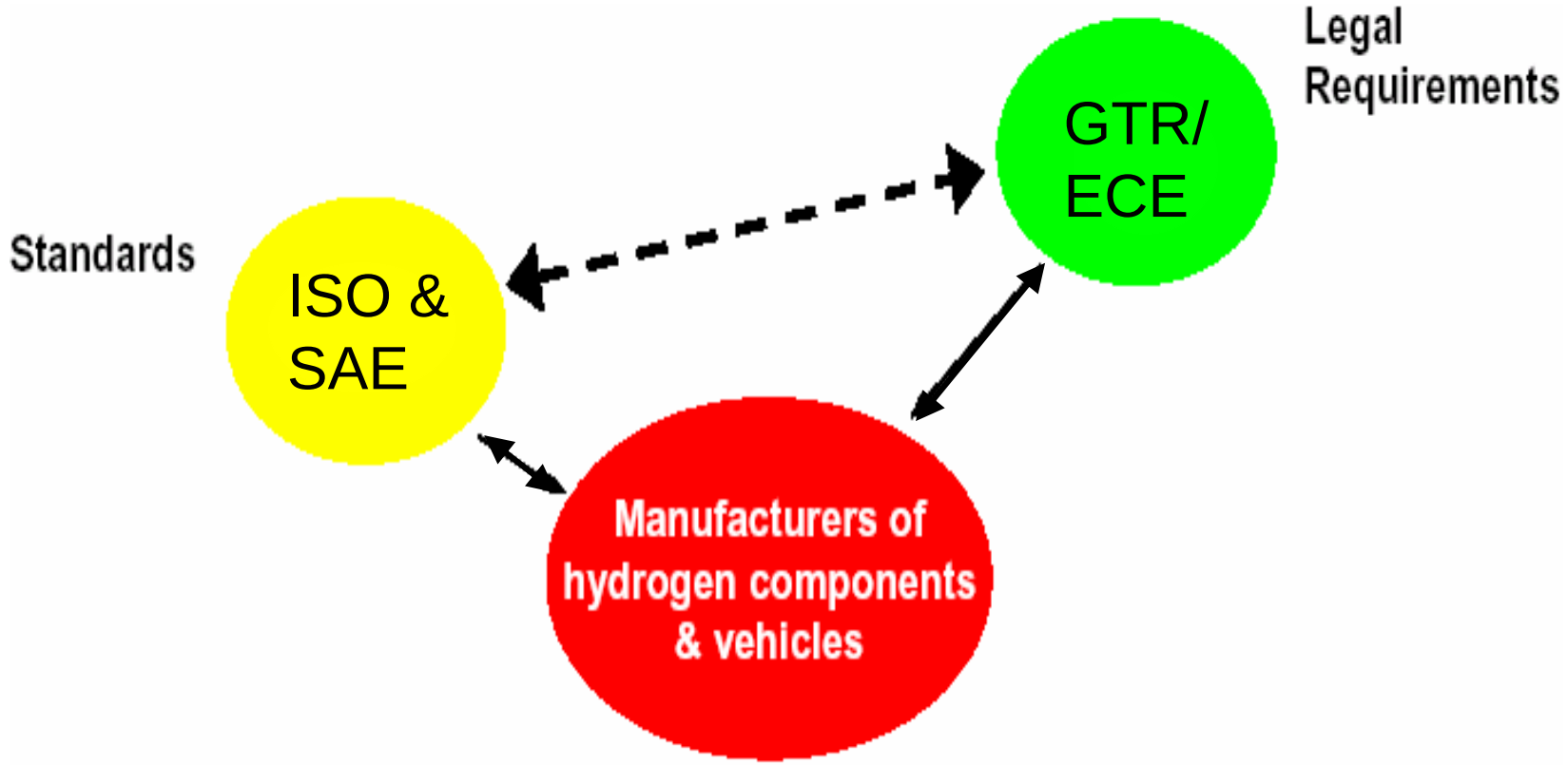


MEMBERS OF THE 1958 AGREEMENT:
[(E/ECE/324-E/ECE/TRANS/505/Rev.2)]
GERMANY, FRANCE, ITALY, NETHERLANDS, SWEDEN, BELGIUM, HUNGARY, CZECH REPUBLIC, SPAIN, YUGOSLAVIA, UNITED KINGDOM, AUSTRIA, LUXEMBOURG, SWITZERLAND, NORWAY, FINLAND, DENMARK, ROMANIA, POLAND, PORTUGAL, RUSSIAN FEDERATION, GREECE, IRELAND, CROATIA, SLOVENIA, SLOVAKIA, BELARUS, ESTONIA, BOSNIA AND HERZEGOVINA, LATVIA, BULGARIA, TURKEY , THE FORMER YUGOSLAV REPUBLIC OF MACEDONIA, EUROPEAN COMMUNITY, JAPAN, AUSTRALIA, UKRAINE, REPUBLIC OF SOUTH AFRICA

MEMBERS OF THE 1998 AGREEMENT:
[(E/ECE/TRANS/132 AND Corr.1)]
CANADA, UNITED STATES OF AMERICA, JAPAN, FRANCE, UNITED KINGDOM, EUROPEAN COMMUNITY, GERMANY, RUSSIAN FEDERATION, PEOPLE'S REPUBLIC OF CHINA, REPUBLIC OF KOREA, ITALY, REPUBLIC OF SOUTH AFRICA, SPAIN

Source: LBST - 2004

Established scenario for Regulations & Standards for <u>Road Vehicles</u> (Europe & Globally)



- Legal requirements should be created only where necessary
- GTRs should refer to available ISO standards

Source: Volvo Technology Corporation / DaimlerChrysler- 2004

Pathway to Regulations
International Consensus for Road Vehicles

Clear vision of a Pathway to a GTR for Fuel Cell/H2 Vehicles*

Onboard storage-related issues ⇒ Two ECE Regulations under the 1958 Agreement (with limited lifetime) ⇒ **GTR** (to replace ECE Regs.)

⇩ ⇩ ⇩

Target date for a regulation 2006

Rest of H2-Vehicle (FC, Safety in normal & crash conditions; Fuel Consumption; etc.) ⇒ ⇒ ⇒ ⇒ **GTR** under the 1998 Agreement (referencing ISO, IEC)

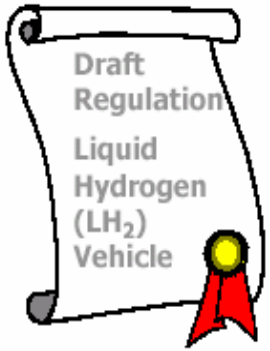
Target date for a regulation ≥ 2010

* *(still under discussion in the UNECE GRPE Informal Group on Hydrogen/Fuel Cell Vehicles)*

Source: LBST - 2004

Conclusions for Europe: H2 Road Vehicles

Harmonised Framework for Europe – UNECE Regulation and/or GTR

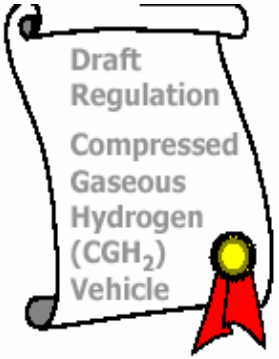


PROPOSAL FOR A NEW DRAFT REGULATION

UNIFORM PROVISIONS CONCERNING THE APPROVAL OF:

I. SPECIFIC COMPONENTS OF MOTOR VEHICLES USING LIQUID HYDROGEN;

II. VEHICLES WITH REGARD TO THE INSTALLATION OF SPECIFIC COMPONENTS FOR THE USE OF LIQUID HYDROGEN



PROPOSAL FOR A NEW DRAFT REGULATION

UNIFORM PROVISIONS CONCERNING THE APPROVAL OF:

I. SPECIFIC COMPONENTS OF MOTOR VEHICLES USING COMPRESSED GASEOUS HYDROGEN;

II. VEHICLES WITH REGARD TO THE INSTALLATION OF SPECIFIC COMPONENTS FOR THE USE OF COMPRESSED GASEOUS HYDROGEN

Source: LBST - 2004

Pathway to Standards for Fuel-Cell Powered Vehicles

Technical Committee in charge:

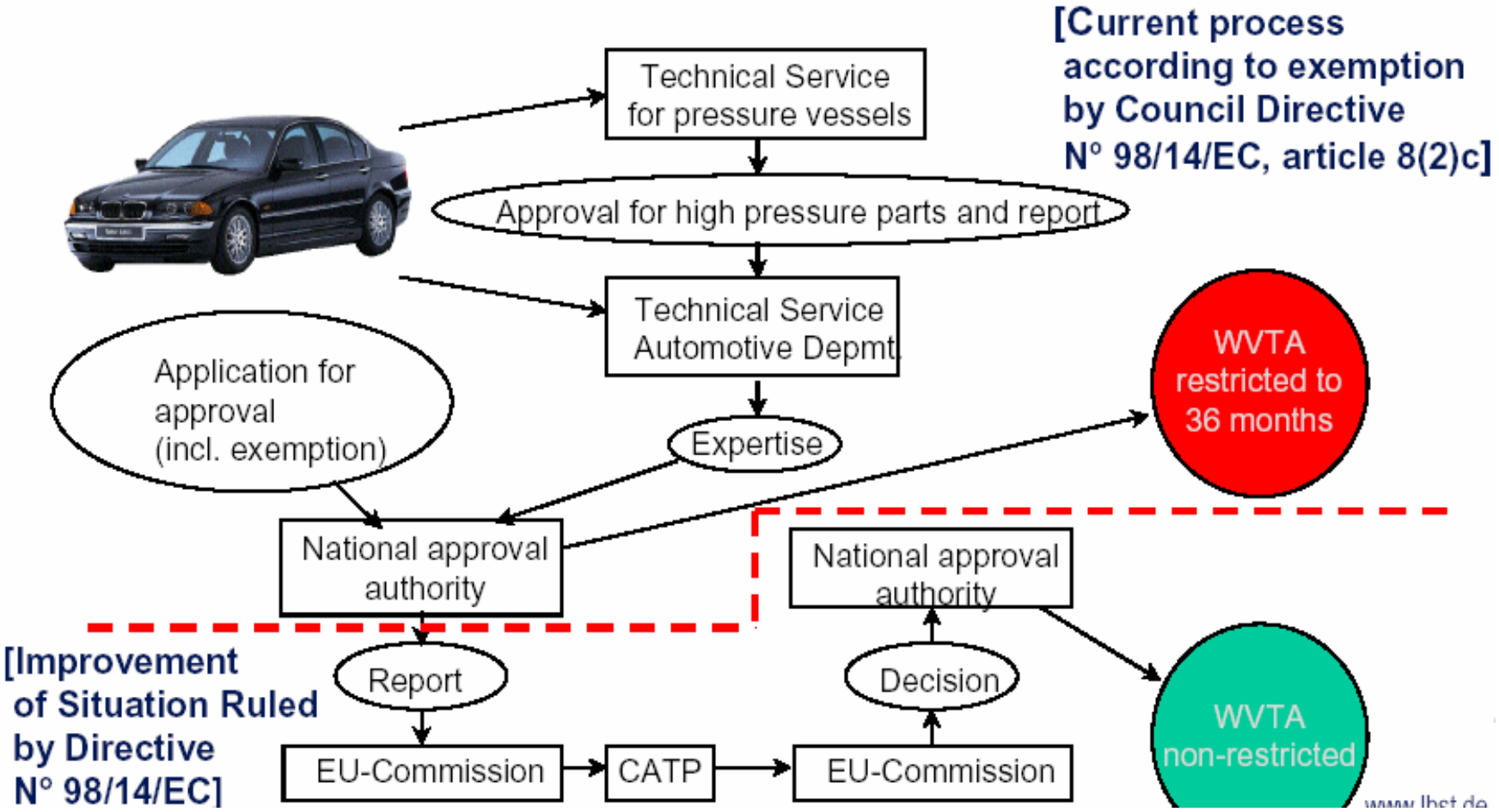
ISO/TC22/SC21 (Electric Road Vehicles)

in cooperation with SAE and ISO/TC197 (Hydrogen Technologies)

Activities of ISO/TC22/SC21:
Vehicle functional safety, Protection against hydrogen hazards, Protection of persons against electric shock, Exhaust emissions and fuel consumption, Glossary of terms relating to fuel cell vehicles, Energy performance measurement

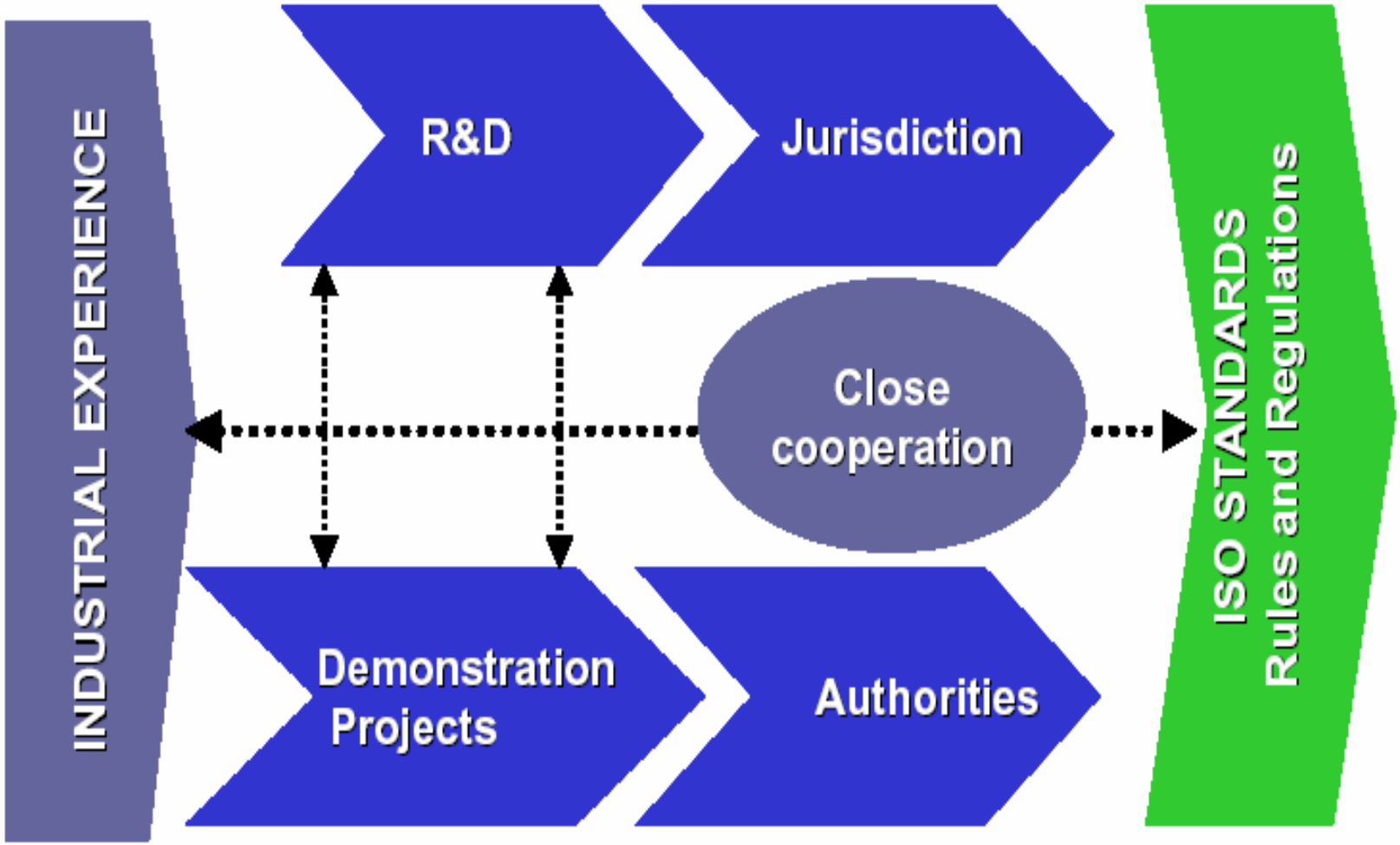
Standards will be available by 2006

Conclusions for Europe for H2 vehicles powered by ICE (Internal Combustion Engines)
NOT APPLICABLE FOR FUEL-CELL POWERED VEHICLES!
Harmonised framework for Europe – or the EEC Directive



Source: BMW/ LBST - 2004

Approval of H2 Refuelling Infrastructure
Approach for development of ISO Standards for H2



Source: Norsk Hydro - 2003

Approval of H2 Refuelling Infrastructure
Gas Merchant's View

The distribution and delivery of Hydrogen through pipelines, liquid bulk, and cylinders is well known in the industries as well as industrial filling installations. Major difference in Hydrogen Energy is environment (urban sites, public) and New Technologies required for improved performances (autonomy, fast filling).

Today environmental policies are not very well harmonized between European Countries (e.g. Safety distances around LH2 storages) whereas a lot has been achieved in transport policies through EEC Directives, as well as UNECE Global approach for vehicles.

Developing infrastructures for Hydrogen supply will require:

- Better harmonisation and standardisation in risk assessment analysis methodology - worst case accident scenarios.
- Standardisation for implementation of new technologies and new components.
- To improve feed back coming from Hydrogen projects.
- Sharing and harmonisation of C&S programs between Europe USA and Japan

Source: Air Liquide

Approval of H2 Refuelling Infrastructure: example Europe
Local implementation will also have to follow local requirements

Normally the approval process takes several months and includes the following steps:

- Application for authorization
- Response from the authorities: A permission document with detailed description of all requirements
- Public hearing of the permission document
- Permission to build / establish the facilities
- Inspections of the established facilities, by Public Authorities / Notified Body
- Approval of the facilities and permission to operate

Licences, permits, and certificates :

- Building licence
- Environmental licence
- Operational licence
- CE certificates (which includes detailed documentation of the equipment)
- Third party inspection document / certificate

Authorities involved in the approval process are normally:

- Environment Authorities
- Fire and Explosion Authorities
- Municipal Building Authorities
- Civil Work Authorities

Important aspects regarding authority approval

- Relevant national regulations
- Risk analysis
  - knowledge about hydrogen safety related properties not yet fully explored
  - relevant operation and accident statistics missing or insufficient
- CE marking
  - dependent on risk analysis, testing and operation experience

Source: Norsk Hydro/ LBST - 2004

Approval of H2 Refuelling Infrastructure

Suggestions on ‘what to do’ as derived from EIHP2 experience & knowledge

- Europe has already a draft ‘working document’ for CGH2 refuelling stations developed under the EIHP2 Project. This ‘working document’ is not recognised as law in member states (MS), however, it is important that we have regulations which can be transferred to country laws uniformly.
- H2 vehicles should be refuelled the same way at the same type of H2 refuelling station with the same regulatory requirements
  - Develop a ‘Handbook for the development of H2 refuelling stations’ for all of Europe, using experiences & knowledge gained from previous infrastructure projects
  - Involve local authorities in MS countries in review processes & update Handbook accordingly
  - Specific safety scenarios will be studied, demonstrated & cross-checked with HySafe findings

Recommendations Globally:
H2/FC Components/Stationary Equipment – International Stds

ISO and IEC standards are required for:

- H_2 production equipment ⇨ ISO/TC 197
- Service stations ⇨ ISO/TC 197
* Filling connectors ⇨ ISO/TC 197 and ISO/TC 22
- Fuel cells ⇨ IEC/TC 105
* Onboard H_2/FC equipment ⇨ ISO/TC 197, ISO/TC 22 and IEC/TC105
- Others

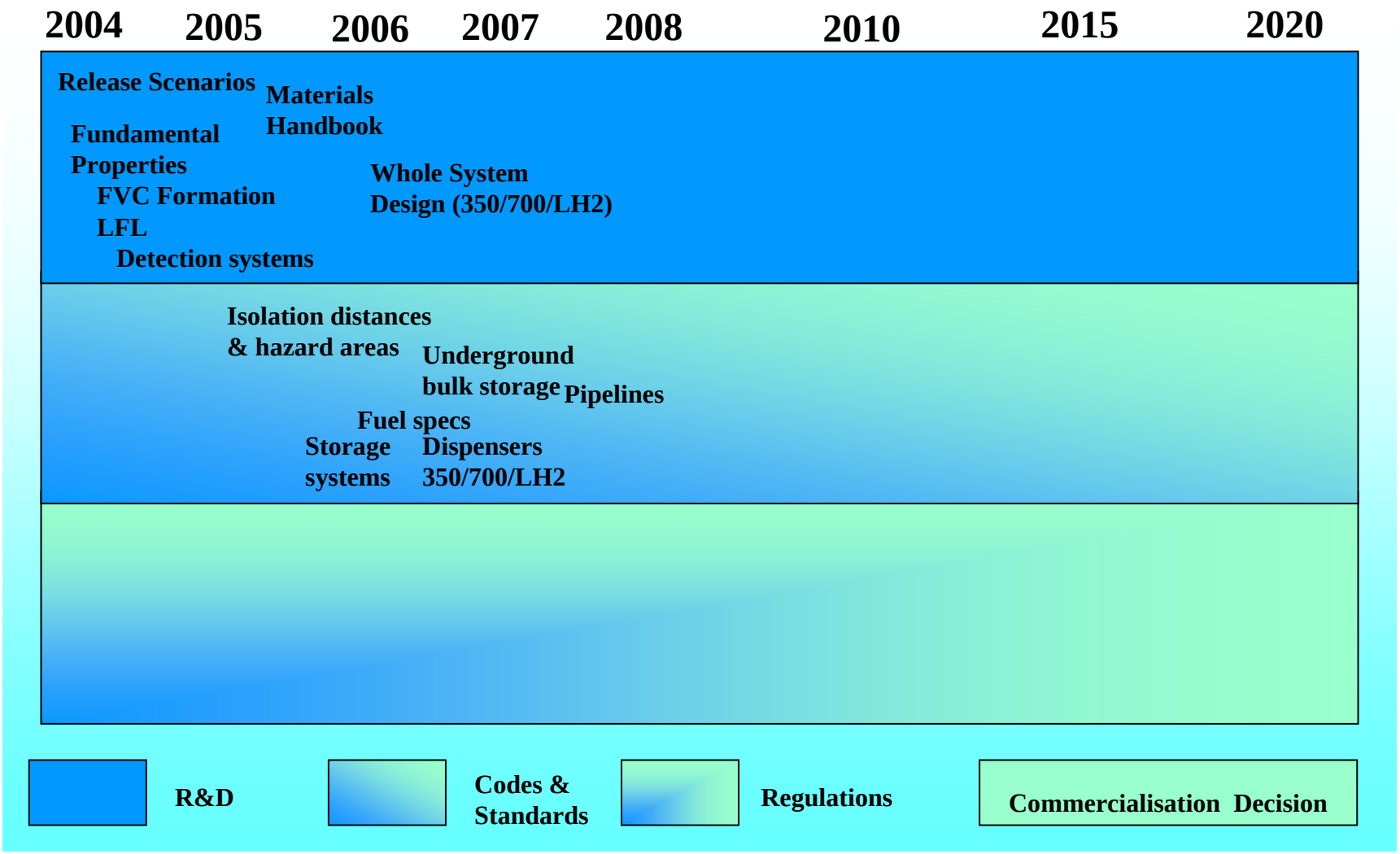
* *For hydrogen, ISO/TC 197 will work with other TCs in joint working groups.*

Source: LBST - 2004

Action Plan Approach

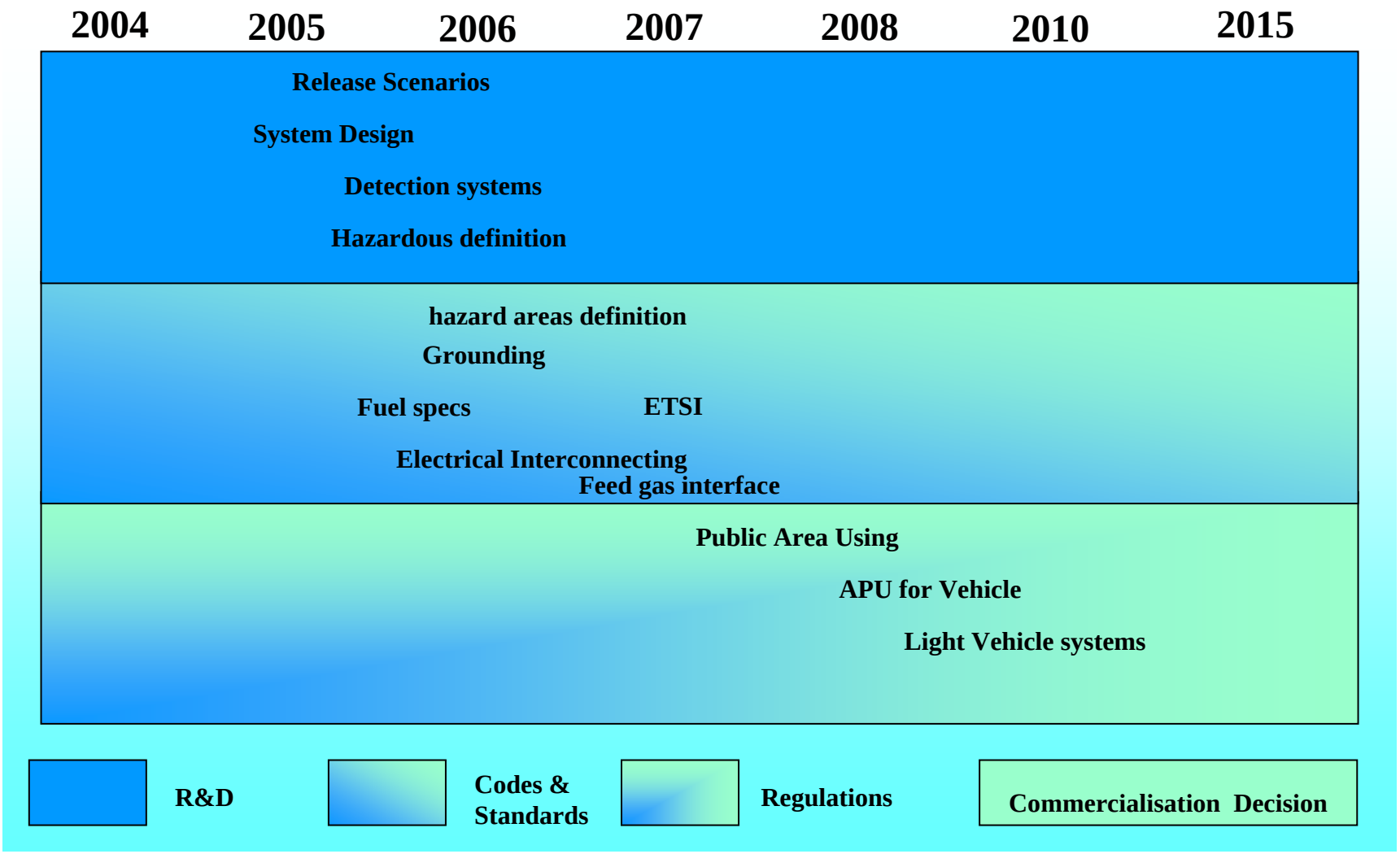
- Develop unified EU agenda for RCS by:
  - National templates adopted by consensus of SDOs
    - Accelerate development of priority standards
    - Designate lead & supporting SDOs
    - Provide support to lead SDOs
    - Facilitate access to standards through EU website
- Involvement in national codes & standards activities by:
  - EU IG-RCS Membership Team & liaison with SPs – SRA & DS
  - IG-RCS membership in EU Projects (eg: HySafe, HarmonHy, HyApproval, etc)
    - Fundamental properties & behaviour of hydrogen
    - FCVs
    - Fuel infrastructure
    - FCs & stationary
- Harmonise technical standards through participation in preparation of international standards eg ISO, CEN & CENELEC
- Coordination of European interests in the field of regulations for road-vehicle applications needed

Action Plan – Overall Timetable



Note: not valid for road-vehicle applications

Action Plan – Portable /stationary FC Timetable



RCS template for H2 Technologies

- Production (Central, On-site: reforming & electrolysis, Home refuellers)
- Delivery (HP composite & conventional, cryogenic, pipelines, tunnels)
- On-site bulk storage (HP composite & conventional, cryogenic)
- Fuel dispensing (Nozzle connector: 350/700 bar & liquid, communication, W&M, Fuel specs)
- Refuelling station site

RCS template for Stationary Applications & Portable FCs

- Interface (Installation, storage, compressor systems, sensors/detectors, fuel specs, W&M, dispensers, non-vehicle dispensing, Electrical and gas coupling, interconnection)
- Hydrogen generators and supply (Electrolysers, reformers, chemical hydrides, performance testing,cylinder,storage)
- Stationary FCs (H2 ICEs, H2 fuelled turbines, performance testing)
- Portable FCs (Handheld, portable systems, fuel containers, H2 fuel specs, performance testing

RCS for Automotive FCV & H2-ICE Systems

- Interface (Fuel specs, Metering - W&M, Sensors, Fuelling & Defuelling, Connectors, Communications)
- Fuel delivery & storage
- Fuelling & service
- Parking & garages
- Tunnels

Interactions & Collaborations

- **Develop C&S only within recognised international bodies, eg: ISO, IEC, CENELEC,…**
- EU HFP: SPs – SRA & DS; IG-E&T; IPHE
- US – DoE, DoT, & national standards orgn's
- Japan – national standards organisations
- EU industry H2 & FC associations & orgn's
- New EU Website (proposed) for Hydrogen & FC RCS & EU H2 Projects
- IPHE

Progress & near term future work

- EU H2 Projects – EIHP2, CUTE, HarmonHy, HyNet, HySafe
- Establish comprehensive education programme for regulatory authorities:
  - ‘Handbook for certification of public refuelling stations’ (HyApproval) - proposal submitted 08DEC2004
- Implement programmes to reduce footprints of H2 fuelling stations
- Support & facilitate completion & adoption of ISO Standards for hydrogen refuelling & storage, electrolysers & reformers (ISO TC197 WGs 8, 9 & 11) & for Fuel Cell Applications (TC 105 – all WGs)
- Work towards a GTR for H2 Road Vehicles (FCVs & ICEs) under UNECE WP.29 GRPE

Potential concerns of European RCS H2 Supply Chain

Today environmental policies are not very well harmonised between European countries (e.g. safety distances around LH2 storage), whereas much has been achieved in transport policies through EC Directives (TPED), ECE Regulation with UNECE Global approach for vehicles.

Development of infrastructures for H2 supply will require:

- Better harmonisation and standardisation on risk assessment analysis methodology. (HySafe Project will address this point).
- Standardisation for implementation of new technologies and new components.
- Sharing and harmonisation of C&S programmes between Europe, USA and Japan

EU RCS ‘Gap Analysis’-provisional conclusions

Status of European H2 Infrastructure:

- RCS for transport distribution applications exist
- Harmonised RCS for environment do not exist
- Permitting Guide or Handbook needed for RCS for development of H2 refuelling stations

RCS financial resources handicap still exists for Europe, effort must be made to improve activities compared to US & Japan.

Summary & recommendations

- Use existing International & European regulatory & standardisation bodies (UN, ISO, IEC, CEN, ETSI) and participate in these bodies more pro-actively
- Identify & harmonise EU regulations for approval of infrastructure as far as possible (initiated from EIHP2 partnership)
- Avoid duplications & contradictory or inconsistent approaches
- Exchange views on harmonisation of international standards through forums of international experts
- Coordination of European interests in the field of regulations for road-vehicle applications needed

IG-RCS Future work: timeline & actions

- Developed a preliminary ‘Gaps Analysis’ by end 2004 – served as input to SPs – SRA & DS
- Development of a more detailed ‘Gaps & Analysis by end Feb 2005 – to serve as input to SPs – SRA & DS
- Prepare by June 2005 detailed Action Report for delivery to AC
- Establish official links with IPHE
- Update ‘Gaps Analysis’ and follow progress in RCS & keep Advisory council informed